

REMARKS

This paper is being presented in response to the non-final official action dated April 29, 2009, wherein claims 17-23, 30-34, 36-40 and 48-75 are pending and have been rejected under 35 USC § 103(a) as being obvious over U.S. Patent No. 6,291,719 (Gao et al.) in view of U.S. Patent No. 3,562,351 (Mertzweiller). Reconsideration and withdrawal of the rejection are respectfully requested in view of the foregoing amendments and following remarks.

This paper is timely filed as it is accompanied by a petition under 37 CFR § 1.136(a) for an extension of time to file in the third month, and payment of the required extension fee.

I. Summary of the Amendments to the Claims

Claim 30 has been amended to correct typographical errors. Specifically, in step (b), two commas have been inserted in the following phrase: "contacting, under catalytic distillation conditions to obtain a C₆ to C₁₈ alkane, the C₆ to C₁₈ alkene."

Each of dependent claims 50, 57, 64, and 71 has been amended to specify that the recited group VIII metal is nickel. Written description support for the amendment to these claims can be found in the version of the claims that existed prior to this amendment, which version recited a Markush group of metals one of which is nickel.

Each of dependent claims 54, 61, 68, and 75 has been amended to no longer recite that the group VIII metal is in the zero oxidation state.

Each of dependent claims 57-59 and 61 has been amended to more clearly recite the group VIII metal "in the first catalytic composite." Dependent claim 60 has been amended to depend from claim 58 instead of claim 30.

Each of claims 53, 60, and 67 has been amended to depend from claims 51, 58, and 65, respectively, wherein antecedent basis is found for the term "metal salts."

New dependent claims 76 and 77 have been added. New claim 76 recites that the group VIII metal in the second catalytic composite includes a group VIII metal which is in the zero oxidation state. Written description support for claim 76 can be found in original (cancelled) claim 15. New claim 77 recites that the group VIII metal in the second catalytic composite includes palladium, platinum, or rhodium. Written description support for claim 77 can be found in original (cancelled) claim 16.

By the foregoing amendments, no claims are being cancelled but two dependent claims are being newly-added. Submitted herewith is an authorization for payment in the

amount of \$52.00 to cover the fee set forth at 37 CFR § 1.16(i) for examination of two claims in excess of twenty.

The foregoing amendments *do not* introduce new matter into the application or into the claims. Importantly, the claim amendments *do not* necessitate a new search and, therefore, any further action rejecting the claims on newly cited prior art may not be made final. See MPEP § 706.07(a) (8th ed., Rev. 6, Sept. 2007) (stating that a "second or any subsequent action on the merits in any application ... should not be made final if it includes a rejection, on prior art not of record, of any claim amended to include limitations which should reasonably have been expected to be claimed").

II. The 35 USC § 103(a) Rejection

Claims 17-23, 30-34, 36-40, 48-75 have been rejected under 35 USC § 103(a) as being obvious over U.S. Patent No. 6,291,719 (Gao et al.) in view of U.S. Patent No. 3,562,351 (Mertzweiller). See the Action at pp. 2-8. The applicants respectfully submit that the subject matter recited in these claims (as amended herein) is not obvious over the combined disclosures of the applied prior art. A complete response to the obviousness rejection is set forth below.

A. Proper Basis for a § 103(a) Rejection

The patent statute states:

A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

35 USC § 103(a). A determination that a claimed invention is obvious under § 103(a) is a legal conclusion involving four factual inquiries: (1) the scope and content of the prior art; (2) the differences between the claimed invention and the prior art; (3) the level of ordinary skill in the pertinent art; and (4) secondary considerations, if any, of non-obviousness. *Graham v. John Deere Co.*, 383 U.S. 1, 17-18 (1966). Obviousness is determined from the vantage point of a hypothetical person having ordinary skill in the art to which the claimed subject matter pertains, who is presumed to have all prior art references in the field of the invention available to him/her. *In re Rouffet*, 149 F.3d 1350, 1357 (Fed. Cir. 1998). Furthermore, obviousness must be determined as of the time the invention was made and in view of the state of the art that existed at that time. *Uniroyal, Inc. v. Rudkin-Wiley Corp.*, 837 F.2d 1044, 1050-51 (Fed. Cir. 1988).

The Patent Office "has the burden under § 103 to establish a *prima facie* case of obviousness." *In re Fine*, 837 F.2d 1071, 1074 (Fed. Cir. 1988); MPEP § 2142 (8th Ed., Rev.

6, Sept. 2007) ("The examiner bears the initial burden of factually supporting any *prima facie* conclusion of obviousness."). The Supreme Court recently identified a number of rationales that may be used to support a conclusion of obviousness, consistent with the framework set forth in its decision in *Graham v. John Deere Co.* See *KSR Int'l Co. v. Teleflex Inc.*, 127 S.Ct. 1727, 1739-40 (2007). These and other representative rationales are described at MPEP § 2143 (8th Ed., Rev. 6, Sept. 2007). Regardless of the supporting rationale, however, the Patent Office must clearly articulate facts and reasons why the claimed invention "as a whole" would have been obvious to a hypothetical person having ordinary skill in the art at least as of the claimed invention's effective filing date. See *KSR Int'l*, 127 S.Ct. at 1741 (citing with approval *In re Kahn*, 441 F.3d 977, 988 (Fed. Cir. 2006) ("[R]ejections on obviousness grounds cannot be sustained by mere conclusory statements; instead, there must be some articulated reasoning with some rational underpinning to support the legal conclusion of obviousness.")); see also MPEP § 2143 ("The key to supporting any rejection under 35 USC § 103 is the clear articulation of reason(s) why the claimed invention would have been obvious.").

B. The § 103(a) Rejections Are Traversed

The action does not clearly articulate facts and reasons why the claimed invention "as a whole" would have been obvious to a hypothetical person having ordinary skill in the art at least as of the claimed invention's effective filing date. Specifically, the action does not articulate accurate findings of fact relating to the scope and content of the prior art, and the differences between the claimed invention and the prior art. Still further, while the action appears to rationalize its conclusion of obviousness, the action does not articulate facts sufficient to support the asserted rationale. See MPEP § 2143. The action, therefore, does not set forth a *prima facie* case of obviousness. Accordingly, the applicants respectfully traverse the rejections, and request reconsideration and withdrawal of the rejections.

1. Claims 17-23 Recite Non-obvious Subject Matter

Independent claim 17 recites a process for the selective dimerization of a lower alkene to a C₆-C₁₂ alkene, under catalytic distillation conditions, using a catalytic composite that includes the recited support structure and a catalytically active species deposited on that support structure.

According to the action, the Patent Office contends that such a process would have been obvious to a person of ordinary skill in the art over the combined teachings in the Gao and Mertzweiller patents:

Since both Mertzweiller and Gao both teach catalysts made from Group VIII metals on a non-zeolite support structure, the catalyst of Gao is functionally equivalent to the catalyst disclosed in Mertzweiller and thus, is capable of carrying out the same reaction (i.e. dimerization" . Therefore , it would have been obvious to one of

ordinary skill in the art at the time of invention to use a functionally equivalent catalyst, such as that taught by Gao, in the process taught by Mertzweiller.

The Action at p. 3, lines 6-9.

The applicants, however, respectfully disagree. Specifically, the applicants disagree that the skilled artisan would have contemplated such a combination of patents. The assertion in the action that "the catalyst of Gao is functionally equivalent to the catalyst disclosed in Mertzweiller" is incorrect. The catalyst of Mertzweiller is a supported organometallic complex and not a metal oxide or a metal on alumina catalyst as disclosed by Gao. Mertzweiller teaches that the catalyst is activated by treating with an organometallic compound, and a drawing of the catalyst taught by Mertzweiller is shown in column 6, lines 36-45, of that patent, where *M* represents a metal species bonded with an organo, hydrocarbyl or *R*₁ substituent, to a support surface. The applicants respectfully submit that it would be clear to the ordinarily skilled artisan that the catalyst cited by Mertzweiller and Gao are very different catalysts, both in terms of functionality and structure, and the interchangeability of such catalysts would not have been expected by the skilled artisan. Accordingly, the substitution of the Mertzweiller catalyst into the Gao process, as asserted in the action, would not have been contemplated by the ordinarily skilled artisan.

In addition, the structural differences between the catalysts described in Mertzweiller and Gao are such that the ordinarily skilled artisan would not have substituted the catalyst of Mertzweiller in the process described by Gao. In Mertzweiller, the catalyst is in the form of an organometallic complex which is deposited on a support. In Gao, however, the catalyst species is not supported but itself forms the catalyst body by molding the catalyst species with a small amount of binder material. See the Gao patent at col. 4, lines 33-36. The applicants respectfully submit that the catalyst species in both patents are so structurally dissimilar that the ordinarily skilled artisan would not have expected that they could be substituted in the respectively disclosed processes. Further, the Gao patent recites:

...as to the prior art using the method of coating the skeleton of packing type with the catalyst materials, the catalyst material coating is only a small portion of the whole catalyst pellet, so the contact of catalyst material is low based on the unit volume of the catalyst bed in the reaction section, there is less chance of contact between reaction material and catalyst, and thus it is low in reaction efficiency.

Id. at col. 4, lines 36-44. The applicants respectfully submit that the Gao patent actually teaches away from using a supported catalyst for use in the catalytic distillation process, which would have further discouraged the skilled artisan from substituting the catalyst species from Mertzweiller into the catalytic distillation process disclosed by Gao.

Further, Mertzweiller simply teaches the use of a batch autoclave to carry out the process, and there would have been no expectation that a catalyst suitable for use in a batch

autoclave would be suitable for use in combined reaction and separation in a catalytic distillation process.

Finally, while the action states that Gao teaches the use of conventionally shaped catalysts such as Raschig rings, saddle shapes, spheres and cylinders, the applicants note that the action does not take into account the complete teachings of the Gao patent. Specifically, the paragraph to which the action cites to support the above statement continues to recite:

However, Raschig rings, which has low external surface area and weak strength, are unfavourable to the reaction and fractionation; wheel shaped catalyst has a low external surface area and low allowable flow flux of vapour and liquid; Pall rings and rectangular saddle shape are difficult to be moulded directly with the catalyst materials; the spherical and cylindrical catalysts have too small free space formed in the beds and higher flow resistance to allow the vapour and liquid stream passing counter currently through the reaction section; as for said ripple or beehive shaped regular pickings, they also need to be loaded and unloaded manually in the column, and they are also difficult to be made with the materials catalyst directly.

The Gao patent at col. 2, line 59, to column 3, line 5. Accordingly, a more complete review of the teachings of Gao would have led the skilled person away from using as supports Raschig rings, saddle shapes, spheres and cylinders.

In view of the above, the applicants respectfully submit that the subject matter recited in claim 17 is not obvious over the combined teachings of the Gao and Mertzweiller patents. Further, as claims 18 to 23 depend on claim 17 and incorporate the limitations thereof, the applicants respectfully submit that these claims also are not obvious over the applied patents. Reconsideration and withdrawal of the rejection of these claims are respectfully requested.

2. Claims 19 and 20 Recite Non-obvious Subject Matter

According to the action, the Patent Office has further rejected claims 19 and 20, asserting that the claimed embodiments—wherein the catalytic composite is admixed with inert distillation packing (in claim 19), and wherein the ratio of the catalytic composite to inert distillation packing is from 10:1 to 1:10 (in claim 20)—are obvious from the teachings of the Gao patent. Reconsideration of this rejection is respectfully requested.

While the action asserts that Gao teaches the packing of the catalyst composite with inert stainless steel packings, wherein the amount of packing versus the amount of catalyst composite is dependent on the requirement of a given reaction process, the applicants note that Gao actually teaches that the rectification and stripping section are filled with stainless steel mesh-ring pickings. See the Gao patent at col. 8, lines 45-49. However, it must be noted that the rectification and stripping sections are at the top section and bottom section, respectively, of the distillation column. Further, Gao does not teach the admixing (mingling) of the catalyst with the stainless steel packings; the catalyst species and stainless steel packings in Gao are maintained separate. Accordingly, the teachings of Gao cannot be said

to render obvious present claims 19 and 20 as these claims require that the catalyst composite be admixed with an inert distillation packing. Accordingly, the applicants respectfully submit that these claims are not obvious on this separate basis and, therefore, respectfully request reconsideration and withdrawal of the obviousness rejection of these claims.

3. Claim 30 Recites Non-obvious Subject Matter

Claim 30 recites in a first part a process that is generally consistent with the process of claim 17. Accordingly, the applicants respectfully submit that the traversal of the obviousness rejection relative to claim 17 applies equally to claim 30.

Further, while the action suggests that the second part of the claimed process—wherein the C₆ to C₁₈ alkene from step (a) is hydrogenated to C₆ to C₁₈ alkane—would be obvious from the teachings of the Mertzweiller patent, the applicants submit that no such teachings are provided in the Mertzweiller patent.

The action cites column 3, lines 33-36 of the Mertzweiller patent the action's assertion that "Mertzweiller also teaches that the catalyst can be used to hydrogenate alkenes." However, careful reading of this passage of the Mertzweiller patent shows that no such teachings are provided. In fact, the Mertzweiller patent *teaches away* from the hydrogenation process presently claimed. In the paragraph spanning column 3, lines 33-46, of the Mertzweiller patent, it is discussed that diolefins (i.e. di-alkenes) can be present in the process streams of olefins (i.e. alkenes), and that these diolefins can be removed from the olefins by hydrogenation. The Mertzweiller patent, however, states only that it is these diolefins that are hydrogenated, and there is no indication that the olefin species, be they the original feedstock or the obtained olefin dimer, remain unaffected by the hydrogenation. Accordingly, the ordinarily skilled artisan would expect, from the teachings of the Mertzweiller patent, that the catalyst described therein would only be able to hydrogenate diolefins, mono-olefin species remaining unaffected. As such, there would be expectation that the complete process presently claimed, wherein a C₂ to C₆ alkene is dimerized to a C₆ to C₁₈ alkene, which dimer is then hydrogenated to a C₆ to C₁₈ alkane, could be achieved by the combined teachings of the Gao and Mertzweiller patent.

In view of the above, the applicants respectfully submit that claim 30 and claims dependent thereon are not obvious in view of the teachings of the applied patents. Reconsideration and withdrawal of the rejection of these claims are respectfully requested.

4. Claims 36-38 Recite Non-obvious Subject Matter

Claim 36 recites a process that is generally consistent with the process of claim 17. Accordingly, the applicants respectfully submit that the traversal of the obviousness rejection relative to claim 17 applies equally to claim 36.

The action rejects claims 37 and 38, which recite that each C₂-C₆ alkene in the mixture is oligomerized within different reactive zones found in a single catalytic distillation column (claim 37), or that each C₂-C₆ alkene is oligomerized within different reactive zones found in two or more linked catalytic distillation column (claim 38). According to the action, a distillation column will inherently characterize a temperature gradient, and as a result, alkenes will tend to congregate in specific zones within the distillation column a result of their boiling points. However, the applicants respectfully submit that the action does not recognize that a catalytic distillation process is distinctly different than a distillation process. The kinetics of the catalytic reaction will affect the distribution of the alkenes in the distillation column. The model for catalytic distillation is much more complex than distillation alone. One of ordinary skill in the art, using only a distillation model, will not be able to design an optimal catalytic distillation process. Further, claim 37 offers a process wherein a mixture of C₂-C₆ alkenes can be oligomerized such that each C₂-C₆ alkene reacts substantially only with identical species. Such a selective process is neither disclosed or suggested by Mertzweiller, and it would not have been obvious to the skilled person that carrying out a dimerization reaction within a catalytic distillation format would provide such selectivity.

In view of the above, the applicants respectfully submit that claim 36, and the claims dependent thereon, are not obvious in view of the teachings of the applied patents. Reconsideration and withdrawal of the rejection of these claims are respectfully requested.

5. Claim 40 Recites Non-obvious Subject Matter

Claim 40 recites a process that is generally consistent with the process of claim 17. Accordingly, the applicants respectfully submit that the traversal of the obviousness rejection relative to claim 17 applies equally to claim 40.

The action overlooks the fact that claim 40 recites that the C₂-C₆ alkenes are in admixture with C₁-C₆ alkanes. Alkanes are inert in the claimed process, but are used in the reaction to control exotherms and reduce the possibility of a run-away reaction due to the highly exothermic process of dimerization. As the Gao patent does not teach the addition of alkanes to the catalytic distillation apparatus as inerts, and that the process described in the Mertzweiller patent also fails to recite use of such an additive, it is clear that all of the limitations recited in claim 40 are not taught by the applied patents, evidencing that claim 40 is not obvious in view of these patents.

In view of the above, the applicants respectfully submit that claim 40 and claims dependent thereon, are not obvious in view of the teachings of the applied patents. Reconsideration and withdrawal of the rejection of these claims are respectfully requested.

6. Claims 49, 56, 63, and 70 Recite Non-obvious Subject Matter

The action rejects claims 49, 56, 63, and 70, asserting that the Gao patent teaches the use of Raschig rings. As noted above, however, the Gao patent actually *teaches away* from the use of Raschig rings, stating: "However, Raschig rings, which has low external surface area and weak strength, are unfavorable to the reaction and fractionation." Accordingly, claims 49, 56, 63, and 70, which specifically require the use of Raschig rings in the catalyst composite, would not be rendered obvious from the teachings of the Gao patent. Reconsideration and withdrawal of the obviousness rejection of these claims are respectfully requested.

7. Claims 52, 59, 66, and 73 Recite Non-obvious Subject Matter

The action rejects claims 52, 59, 66, and 73, which recite that the catalytically active species is nickel sulphate or nickel chloride, asserting that the Mertzweiller patent teaches nickel chloride or nickel sulphate as the catalytic species. To the contrary, however, column 4, lines 7-26 of the Mertzweiller patent does not provide such teachings. This passage of the Mertzweiller patent teaches that nickel chloride or nickel sulphate can be used to impregnate the metal into the support. The catalytic species taught in the Mertzweiller patent, however, is an activated organometallic compound. Accordingly, the Mertzweiller patent does not teach the use of nickel chloride or nickel sulphate as the catalytic species, and claims 52, 59, 66 and 73 are therefore not obvious in view of the cited patents. Reconsideration and withdrawal of the obviousness rejection of these claims are respectfully requested.

8. Claims 53, 60, 67, and 74 Recite Non-obvious Subject Matter

The action rejects claims 53, 60, 67, and 74, which recite that the metal salt is in an ionic state and the catalytically active species is in admixture with ammonium sulphate or ammonium phosphate, asserting that the Gao patent teaches using a mixture of ammonium and sulphate to bind the metal salt containing the catalytic species. While the action cites column 7-8 of the Gao patent to support this rejection, the applicants respectfully submit that the Patent Office has misconstrued the teachings of the Gao patent. It is noted that the Gao patent states: "zirconium nitrate is used as a feedstock, colloided by adjusting pH value to 8-12, preferably 9-11, with aqueous NH₄OH solution and the resulting colloid is filtered, washed to neutrality, after dried to 100-200 °C, the product is sulfonated with sulfuric acid, washed with water, and after a binder is added, the activated product is molded into one of the shapes shown in Fig 2 and Fig 3." The applicants respectfully submit that the Gao patent therefore teaches use of ammonia to adjust the pH of the solution, and not as a catalyst, and teaches

use of sulfuric acid to sulfonate the colloid mixture. Such teachings cannot be equated to the presently claimed subject matter, which recites that ammonium sulphate is used as the catalytic species. Reconsideration and withdrawal of the rejection of these claims are respectfully requested.

C. Conclusion

In view of the foregoing, the applicants respectfully traverse the § 103(a) rejections, and respectfully submit that the claimed invention is patentable under all the criteria relevant to a determination of unobviousness. The applicants, therefore, request reconsideration and withdrawal of the rejections.

Prima facie obviousness under § 103 is a legal conclusion—not a fact—based on underlying facts. *In re Rinehart*, 531 F.2d 1048, 1052 (CCPA 1976); *In re Kumar*, 418 F.3d 1361, 1365 (Fed. Cir. 2005) (“Determination of obviousness under 35 USC § 103 is a legal conclusion based on underlying facts.”). The foregoing response identifies facts (e.g., evidence in the form of statements in the prior art) rebutting the alleged legal conclusion that the claimed invention is prima facie obvious. All of these facts must be evaluated along with the facts on which the legal conclusion was originally reached—not the legal conclusion itself. Having requested herein reconsideration of the legal conclusion set forth in the official action, the Patent Office is obligated to address all of the evidence and base its forthcoming legal conclusion(s) on such evidence, uninfluenced by its earlier conclusions. *Rinehart*, 531 F.2d at 1052.

CONCLUSION

In view of the foregoing, the applicants respectfully request entry of the amendments to claims 30, 50, 53, 54, 57-61, 64, 67, 68, 71, and 75, entry of new claims 76 and 77, reconsideration and withdrawal of the rejections, and allowance of all pending claims 17-23, 30-34, 36-40 and 48-77.

Should the examiner wish to discuss the foregoing, or any matter of form or procedure in an effort to advance this application to allowance, the examiner is urged to contact the undersigned attorney.

Respectfully submitted,

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